

**Amendments to the Claims:**

The listing of claims below replaces prior versions of claims in the application:

1. (currently amended): A computer rendering method comprising:  
moving a semitransparent plane including a plurality of reflection points relative to an axis; and  
rendering an image of the plurality of reflection points at a plurality of positions with respect to the axis such that each said point maps an ~~elongate~~ elongated, continuous image.

2. (original): The computer rendering method as defined in Claim 1, wherein moving the semitransparent plane including the plurality of reflection points relative to the axis comprises rotating the plane about, and translating the plane with respect to, the axis.

3. (original): The computer rendering method as defined in Claim 1, wherein moving the semitransparent plane including the plurality of the reflection points relative to the axis comprises moving the plane of the reflection points perpendicular with respect to the axis.

4. (original): The computer rendering method as defined in Claim 3, wherein moving the semitransparent plane including the plurality of the reflection points perpendicular with respect to the axis further comprising rotating the plane about, and translating the plane with respect to, the axis.

1  
2 5. (original): The computer rendering method as defined in Claim 1,  
3 wherein rendering the image comprises rendering a 3D model from a combination  
4 of images of the plurality of reflection points at a plurality of positions with  
5 respect to the axis.

6  
7 6. (previously presented): The computer rendering method as defined  
8 in Claim 1, wherein:

9 a plurality of control points, each being located at an intersection of two  
10 axes, define a three-dimensional (3D) surface of a macrostructure;

11 moving the semitransparent plane including the plurality of reflection  
12 points relative to the axis further comprises rotating and translating the plane of  
13 the reflection points respectively about and along each said axis of the 3D surface  
14 of the macrostructure; and

15 rendering the image of the plurality of reflection points further comprises  
16 rendering a 3D model from a plurality of images of a plurality of positions of the  
17 planar plurality of reflection points with respect to each said axis of the 3D surface  
18 of the macrostructure.

19  
20 7. (original): A computer-readable media comprising computer-  
21 executable instructions for performing the computer rendering method as recited  
22 in Claim 1.

23  
24 8. (original): A modeling method comprising:  
25

1 generating a macrostructure for a three-dimensional (3D) object defined by  
2 a plurality of axes; and

3 applying a semitransparent microstructure, defined by planar plurality of  
4 reflection points, to the macrostructure by moving the plane of the reflection  
5 points with respect to each said axis to yield a 3D model.

6  
7 9. (original): The modeling method as defined in Claim 8, wherein  
8 moving the plane of the reflection points with respect to each said axis comprises  
9 rotating the plane about, and translating the plane with respect each said axis while  
10 perpendicular thereto.

11  
12 10. (original): The modeling method as defined in Claim 8, wherein the  
13 microstructure simulates a cross section of a material selected from the group  
14 consisting of:

15 human hair;

16 animal fur;

17 yarn; and

18 foliage.

19  
20 11. (original): The modeling method as defined in Claim 8, wherein the  
21 yield of the 3D model comprises rendering the 3D model from a combination of  
22 images of the plurality of reflection points at a plurality of positions with respect  
23 to the axes.  
24  
25

1           12.   (original): A computer-readable media comprising computer-  
2 executable instructions for performing the modeling method as recited in Claim 8.

3  
4           13.   (original): A method for rendering knitwear, the method  
5 comprising:  
6           generating a macrostructure for a three-dimensional (3D) object defined by  
7 a plurality of intersecting axes;  
8           applying a stitch pattern to each said axis; and  
9           applying a semitransparent lumislice to each said stitch pattern to yield a  
10 3D knitwear model.

11  
12           14.   (original): The method as defined in Claim 13, wherein applying the  
13 semitransparent lumislice to each said stitch pattern comprising translating and  
14 rotating the lumislice perpendicular to and respectively along and about each stitch  
15 of the stitch pattern applied to the plurality of intersecting axes.

16  
17           15.   (original): The method as defined in Claim 13, wherein the yield of  
18 the 3D knitwear model comprises rendering the 3D model from a combination of  
19 images of the lumislice at a plurality of positions with respect to the axes, wherein  
20 the 3D knitwear model accounts for reflective interactions among the lumislices at  
21 different locations on the macrostructure.

22  
23           16.   (original): The method as defined in Claim 15, wherein the  
24 accounting of the 3D knitwear model for reflective interactions among the  
25

1 lumislices at different locations on the macrostructure includes at least one of the  
2 following:

3 occlusion;

4 shadowing; and

5 multiple scattering among yarn fibers defined by the lumislices.

6  
7 17. (original): A computer-readable media comprising computer-  
8 executable instructions for performing the rendering method as recited in Claim  
9 13.

10  
11 18. (original): A method for rendering knitwear, the method  
12 comprising:

13 generating a macrostructure, the macrostructure being defined by the  
14 plurality of axes connecting a plurality of control points, each said control point  
15 being situated at an intersection of at least two of the axes, the plurality of axes  
16 defining a three-dimensional (3D) object;

17 applying a stitch pattern to each said axis; and

18 applying a yarn microstructure, defined by a planar plurality of reflection  
19 points, to each stitch of the stitch pattern applied to each axis defining the 3D  
20 object by rotating and translating the plane of the reflection points perpendicular  
21 with respect to each said axis to yield a 3D knitwear model.

22  
23 19. (original): The method as defined in Claim 18, wherein generating  
24 the macrostructure is further based on a color pattern.

1           20.   (original): The method as defined in Claim 18, wherein generating  
2 the macrostructure comprises:

3           defining a 3D surface with the control points, the 3D surface being  
4 partitioned into quadrilaterals in accordance with the 3D object and corresponding  
5 to the stitch pattern; and

6           for each quadrilateral of the 3D surface, connecting a plurality of key points  
7 of the quadrilateral with curved segments to yield a stitch loop, the 3D surface  
8 resulting in the macrostructure.

9  
10          21.   (original): The method as defined in of Claim 20, wherein  
11 generating the macrostructure is further based on a color pattern, and further  
12 comprises, for each curved quadrilateral of the 3D surface, applying a color from  
13 the color pattern.

14  
15          22.   (original): The method as defined in of Claim 18, further  
16 comprising, prior to generating the yarn microstructure, introducing irregularities  
17 in stitch positions of the stitch pattern of the macrostructure.

18  
19          23.   (previously presented): The method as defined in Claim 18, wherein  
20 the applying the yarn microstructure comprises:

21           for each stitch of a plurality of stitches of the stitch pattern of the  
22 macrostructure,

23           for each curved segment of a plurality of curved segments of each said  
24 stitch,

25           applying the yarn microstructure to the curved segment.

1  
2 24. (original): The method as defined in Claim 18, wherein the 3D  
3 knitwear model accounts for reflective interactions among the planar plurality of  
4 reflection points at different locations on the macrostructure.  
5

6 25. (original): The method as defined in Claim 24, wherein the  
7 accounting of the 3D knitwear model for reflective interactions among the planar  
8 plurality of reflection points at different locations on the macrostructure include at  
9 least one of the following:

10 occlusion of yarn of yarn microstructure;  
11 shadowing of yarn of yarn microstructure; and  
12 multiple scattering among yarn fibers of yarn of yarn microstructure  
13 defined by the lumislices.  
14

15 26. (original): A computer-readable media comprising computer-  
16 executable instructions for performing the rendering method as recited in Claim  
17 18.  
18

19 27. (currently amended): A computer rendering method comprising:  
20 moving a plurality of voxels contained within parallel opposing planes with  
21 respect to an axis that is perpendicular to the parallel opposing planes, each said  
22 voxel being semitransparent and having a reflectance factor and a plurality of  
23 reflection points having a density; and  
24  
25

1 rendering an image of the plurality of voxels at a plurality of positions with  
2 respect to the axis such that at least one said point maps an ~~elongate~~ elongated,  
3 continuous image.  
4

5 28. (original): The method as defined in Claim 27, wherein moving the  
6 plurality of voxels contained within parallel opposing planes with respect to the  
7 axis comprises rotating the parallel opposing planes about, and translating the  
8 parallel opposing planes with respect to, the axis.  
9

10 29. (original): The method as defined in Claim 27, wherein moving the  
11 plurality of voxels contained within parallel opposing planes with respect to the  
12 axis comprises moving the plurality of voxels contained within parallel opposing  
13 planes perpendicular with respect to the axis.  
14

15 30. (original): The method as defined in Claim 29, wherein moving the  
16 plurality of voxels contained within parallel opposing planes perpendicular with  
17 respect to the axis further comprises rotating the plurality of voxels contained  
18 within parallel opposing planes about, and translating the plurality of voxels  
19 contained within parallel opposing planes with respect to, the axis.  
20

21 31. (original): The method as defined in Claim 27, wherein:  
22 rendering the image comprises rendering a 3D model from a combination  
23 of images of the plurality of reflection points at a plurality of positions with  
24 respect to the axis; and  
25



1 the rendered image accounts for the interaction of each said reflectance  
2 factor of each said voxel with respect to the other voxels of the plurality of voxels  
3 at each said position of said plurality of positions.

4  
5 32. (original): The method as defined in Claim 27, wherein:  
6 a plurality of control points, each being located at an intersection of two  
7 axes, define a three-dimensional (3D) surface of a macrostructure;  
8 moving the planar plurality of reflection points perpendicular relative to the  
9 axis further comprises rotating and translating the plane of the reflection points  
10 respectively about and along each said axis of the 3D surface of the  
11 macrostructure; and  
12 rendering the image of the plurality of reflection points further comprises  
13 rendering a 3D model from a plurality of image of a plurality of positions of the  
14 planar plurality of reflection points with respect to each said axis of the 3D surface  
15 of the macrostructure.

16  
17 33. (original): The method as defined in Claim 27, wherein each of the  
18 voxels has an associated opacity and voxel reflectance function (VRF).

19  
20 34. (original): The method as defined in Claim 33, wherein:  
21 the VRF represents the brightness of a voxel viewed from direction  
22  $V(\theta_v, \phi_v)$  when illuminated by a unit intensity light from direction  $L(\theta_l, \phi_l)$ ;  
23 the VRF is represented by a four-dimensional color array after  
24 discretization of the four angles  $\theta_l, \phi_l, \theta_v, \phi_v$ ;  
25  $\theta$  is a longitude angle; and

1  $\phi$  is an altitude angle.

2  
3 35. (original): The method as defined in Claim 34, wherein:  
4 the discretization of the four angles  $\theta_l, \phi_l, \theta_v, \phi_v$  comprises the discretization  
5 into directional increments;  
6 the directional increments for the longitude angle are  $\theta \in [0, 2\pi]$ ; and  
7 the directional increments of the altitude angle are  $\phi_l \in [-\pi/2, \pi/2]$ .

8  
9 36. (original): A computer-readable media comprising computer-  
10 executable instructions for performing the rendering method as recited in Claim  
11 27.

12  
13 37. (original): A method for rendering knitwear, the method  
14 comprising:  
15 generating a macrostructure for a three-dimensional (3D) object defined by  
16 a plurality of intersecting axes;  
17 applying a stitch pattern to each said axis;  
18 applying a yarn microstructure, defined by a plurality of voxels contained  
19 within parallel opposing planes, to the macrostructure by translating and rotating  
20 the plurality of voxels contained within parallel opposing planes perpendicular  
21 respectively along and about each stitch of the stitch pattern applied to each said  
22 axis, wherein each said voxel is semitransparent and has a reflectance factor and a  
23 plurality of points having a density; and  
24 rendering a 3D knitwear model from a combination of images of the  
25 plurality of voxels at a plurality of positions with respect to the plurality of axes.

1  
2 38. (original): The method as defined in Claim 37, wherein generating  
3 the macrostructure is further based on a color pattern.  
4

5 39. (original): The method as defined in Claim 37, wherein:  
6 the plurality of axis connects a plurality of control points each being located  
7 at an intersection of two of the axes; and  
8 generating the macrostructure comprises:  
9 defining a 3D surface with the control points, the 3D surface being  
10 partitioned into quadrilaterals in accordance with the 3D object and corresponding  
11 to the stitch pattern; and  
12 for each quadrilateral of the 3D surface, connecting a plurality of key points  
13 of the quadrilateral with segments to yield a stitch loop, the 3D surface resulting in  
14 the macrostructure.  
15

16 40. (original): The method as defined in of Claim 39, wherein  
17 generating the macrostructure is further based on a color pattern, and further  
18 comprises, for each quadrilateral of the 3D surface, applying a color from the  
19 color pattern.  
20

21 41. (original): The method as defined in of Claim 37, further  
22 comprising, prior to translating and rotating a plurality of voxels contained within  
23 parallel opposing planes, introducing irregularities in stitch positions of the stitch  
24 pattern of the macrostructure.  
25

1           42.   (original): The method as defined in Claim 37, wherein applying the  
2 yarn microstructure, defined by the plurality of voxels contained within parallel  
3 opposing planes, to the macrostructure by translating and rotating the plurality of  
4 voxels contained within parallel opposing planes perpendicular respectively along  
5 and about each stitch of the stitch pattern applied to each said axis comprises:

6           for each stitch of a plurality of stitches of the stitch pattern of the  
7 macrostructure,

8           for each curved segment of a plurality of curved segments of each said  
9 stitch,

10           applying the yarn microstructure by translating and rotating the  
11 plurality of voxels contained within parallel opposing planes perpendicular  
12 respectively along and about each of the curved segments.

13  
14           43.   (original): The method as defined in Claim 37, wherein the 3D  
15 knitwear model accounts for reflective interactions from the reflectance factor of  
16 each of the voxels of the yarn microstructure applied to the macrostructure.

17  
18           44.   (original): A computer-readable media comprising computer-  
19 executable instructions for performing the rendering method as recited in Claim  
20 37.

21  
22           45.   (original): A machine-readable medium having instructions stored  
23 thereon for execution by a processor to perform a method for rendering knitwear,  
24 the method comprising:

1           generating a parameterized surface describing a three-dimensional (3D)  
2           knitwear macrostructure;  
3           determining a plurality of control points that define the parameterized  
4           surface, wherein each said control point is located at an intersection of two axes;  
5           applying a stitch pattern to each of the control points of the knitwear  
6           skeleton to form a skeleton of the yarn stitches;  
7           discretizing the skeleton of the yarn stitches into a plurality of discretized  
8           yarn segments;  
9           sorting the discretized yarn segments according to a viewing condition of a  
10          scene including the knitwear macrostructure and a distance of a view of the scene;  
11          inputting the plurality of discretized yarn segments into:  
12                  a geometry of the scene; and  
13                  a lighting condition of the scene;  
14          applying a lumislice, with respect to a resolution of the distance of the view  
15          of the scene and a sampling density, to each stitch of the stitch pattern of the  
16          sorted discretized yarn segments by translating and rotating the lumislice  
17          perpendicular to and respectively along and about each stitch of the stitch pattern  
18          applied to the plurality of intersecting axes, wherein the lumislice is  
19          semitransparent and is computed from a fiber distribution of a yarn cross-section;  
20          and  
21          rendering a synthesis of the scene including the knitwear macrostructure  
22          using the sorted discretized yarn segments having the lumislice applied thereto, the  
23          viewing condition of the scene, and the distance of the view of the scene.  
24  
25

1           46.   (original): The medium of Claim 45, wherein applying a stitch  
2 pattern to each of the control points of the knitwear skeleton to form a skeleton of  
3 the yarn stitches further comprises applying a color pattern to each of the control  
4 points of the knitwear skeleton to form the skeleton of the yarn stitches.

5  
6           47.   (original): The medium of Claim 45, further comprising, before  
7 applying the lumislice, computing a shadow map from the geometry of the scene  
8 and the lighting condition, wherein the synthesis of the scene is rendered using the  
9 computed shadow map.

10  
11          48.   (original): The medium of Claim 45, wherein:  
12          each said lumislice characterizes attributions of a cross-sectional slice of  
13 yarn of the yarn stitches that is divided into voxels; and  
14          each of the voxels has an associated opacity and voxel reflectance function  
15 (VRF).

16  
17          49.   (original): The medium as defined in Claim 48, wherein:  
18          the VRF represents the brightness of a voxel viewed from direction  
19  $V(\theta_v, \phi_v)$  when illuminated by a unit intensity light from direction  $L(\theta_l, \phi_l)$ ;  
20          the VRF is represented by a four-dimensional color array after  
21 discretization of the four angles  $\theta_l, \phi_l, \theta_v, \phi_v$ ;  
22           $\theta$  is a longitude angle; and  
23           $\phi$  is an altitude angle.

24  
25          50.   (original): The medium as defined in Claim 49, wherein:

1 the discretization of the four angles  $\theta_l, \phi_l, \theta_v, \phi_v$  comprises the discretization  
2 into directional increments;

3 the directional increments for the longitude angle are  $\theta \in [0, 2\pi]$ ; and

4 the directional increments of the altitude angle are  $\phi \in [-\pi/2, \pi/2]$ .